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Abstract

ESSENTIAL FACTORS IN A BALANCED NUCLEAR ECONOMY (THERMAL AND BREEDER REACTORS)

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The report by the U. S. Atomic Energy Commission to President KENNEDY on November 20 th, 1962 started a strong world-wide movement to consider and discuss nuclear economy on a long-term basis. There is general agreement to day that this will consist of thermal and breeder reactors, at least for a long time. Meanwhile earlier articles such as that of MM. ANDRIOT and GAUSSENS, at the operational research Conference at Aix-en-Provence (September 1960), did not attract attention when they appeared. They are now being carefully studied.

For our part we have carried out various investigations during 1963 in an attempt to analyse the future as far as possible, demonstrating for example the essential fact that the higher the growth rate of the total nuclear programme, the more difficult it will be for breeder reactors to take a part. It is only progressively however that we realised the essential role of the following three factors in the development of a balanced economy.:

delays in treatment and manufacture loss of fissile materials in the cycle, hold-up in the inventories.

This paper sets out the equations corresponding to these problems, fixes their dependence as a function of the growth rate of the total nuclear economy, and calculates the degree of penetration of breeders in the overall economy for reasonable values of the various parameters.

For one particular case we have been able to show from these calculations that to vary the net plutonium production of a breeder by 10 p. 100 is

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equivalent, if the extent of penetration of a breeder in a given nuclear economy is to be kept constant, to :

- increasing by eleven months the time the load remains in the pile,
- or decreasing the neutron equilibration period by two months,
- or decreasing the treatment, manufacture etc... time by one month,
- or decreasing the percentage of losses per cycle by 2 p. 100,
- or finding the same degree of penetration for a 4,2 p. 100 lower growth rate.

An organisation for distributing research funds could thus divide its efforts in various directions by making use of the formulae presented in this report.